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The first record of scorpion *Nebo yemenensis* Francke, 1980 in Saudi Arabia

Первая находка скорпиона *Nebo yemenensis* Francke, 1980 в Саудовской Аравии

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КЛЮЧЕВЫЕ СЛОВА: Scorpiones, *Nebo*, Diplocentridae, экология, Асир, Джизан, Саудовская Аравия.

ABSTRACT. *Nebo yemenensis* Francke, 1980 (Arachnida: Scorpiones) is recorded for the first time in Saudi Arabia. Scorpions were collected in the southwestern region of the country, in the highlands of Asir and Jizan Provinces. Morphological description, body measurements, and ecological conditions are provided.

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РЕЗЮМЕ. *Nebo yemenensis* Francke, 1980 (Arachnida: Scorpiones) впервые отмечен н юго-западном регионе Саудовской Аравии. Скорпионы были собраны на высотах Джизана. Приведены описание морфологии, промеры тела и экологические условия.

Introduction

Within the family Diplocentridae Karsch, 1880, the genus *Nebo* includes nine species distributed widely across the Middle East including the Arabian Peninsula [Birula, 1910; Pallary, 1929; Werner, 1929, 1936; Fet, 2000; Prendini *et al*., 2003]. The taxonomic identification of species within this genus has been problematic because they were based on morphometric ratios based on few specimens, as well as other numerous characters such as trichobothrial patterns, pectinal tooth counts, tarsomere II spine formulas, and carination [Francke, 1980; Sissom, 1994; Hendrixson, 2006]. Kinzelbach [1985] and Vachon & Kinzelbach [1987] suggested to treat all taxa in the as subspecies of *N. hierichonticus* (Simon, 1872). On the contrary, Francke [1980] and Sissom [1994] found these morphological characters and morphometric ratios to be consistent and non-overlapping between allopatric populations and regarded them all as valid species. Originally, the species *Nebo yemenensis* was restricted to Yemen [Francke, 1980]. Hendrixson [2006], referring to the the specimens from Saudi Arabia he studied (a very limited sample), noted that some of their diagnostic characters were closer to *N. hierichonticus* while others were closer to *N. yemenensis* Francke, 1980. Thus, the presence of *N. yemenensis* in Saudi Arabia was controversial [Hendrixson, 2006; Alqahtani, Badry, 2021]. Our survey is the first confirmation of *N. yemenensis* occurrence in Saudi Arabia; we also give some ecological considerations.

Materials and Methods

Our study was carried out from August 2018 to January 2021 in southwestern Saudi Arabia. Scorpion specimens were collected from Asir and Jizan Provinces at altitudes from 1500 to 3600 m a.s.l. using ultraviolet light at night. During daytime, scorpions were captured by searching under rocks, stones and by digging burrows. All collected material was kept in 95% alcohol for morphological identification. Specimens were examined using a stereomicroscope (Leica MZ16). The identification was based on morphological criteria as described by Francke [1980].

Results and Discussion

Family Diplocentridae Karsch, 1880
Genus *Nebo* Simon, 1878
Nebo yemenensis Francke, 1980
Figs 2, 3; Tables 1,2.

MATERIAL EXAMINED. Saudi Arabia, Asir Province, Sawda (18°16′ N 42°23′ E, 2890 m a.s.l.), August 2018, 1♀; Almaqadha (18°14′ N 42°25′ E, 2605 m a.s.l.), August 2018, 2 juveniles; Jizan Province, Jizan Region, Khasher (17°21′ N, 43°10′ E, 861 m a.s.l.), January 2019, 1♀; Al-Dayer (17°20′43.8″ N 43° 10′13.3″ E, 825 m a.s.l.), January 2021, 5 juveniles (Fig. 1). Material is preserved and deposited in the Al-Azhar University Zoological Collection (AUZC), Nasr City, Cairo, Egypt.

DESCRIPTION (based on a female from Jizan, Saudi Arabia).

Coloration: Body and pedipalp reddish brown, dark brown to black; sternite and pectin yelwish brown; legs yellow.

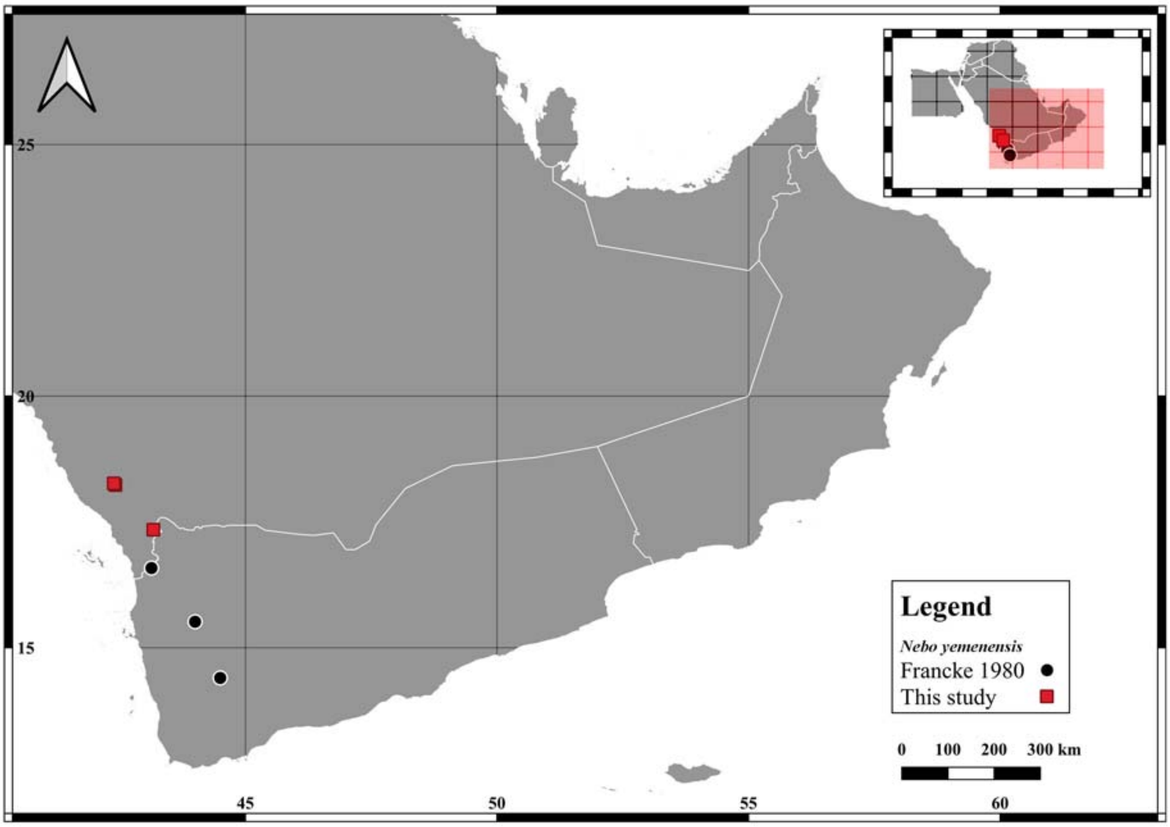


Fig. 1. Map of the known localities of *Nebo yemenensis*. Red squares refer to specimens recorded and deposited at AUZC (Al Azhar University Zoological Collection). Black dots refer to the specimens examined and identified by Franke [1980].

Рис. 1. Карта известных местонахождений *Nebo yemenensis*. Красные квадратики указывают описанные в статье экземпляры, хранящиеся в зоологической коллекции Университета Аль-Азхара, Каир, Египет (AUZC). Черные точки относятся к экземплярам, определенным Franke [1980].



Fig. 2. *Nebo yemenensis* female, dorsal and ventral aspects.

Рис. 2. Самка *Nebo yemenensis*, дорсально и вентрально.



Fig. 3. A–B — *Nebo yemenensis* eating cockroach; C — *Nebo yemenensis* subadult female (right) from Al-Dayer, Jizan, Saudi Arabia and *N. hierichonticus* male (left) from Jordan in captivity.

Рис. 3. A–B — *Nebo yemenensis*, поедающий таракана; C — субадультная самка *Nebo yemenensis* (справа) из Al-Dayer, Джизан, Саудовская Аравия и самец *N. hierichonticus* (слева) из Иордании в неволе.

Prosoma: carapace as long as wide at the posterior margin, smooth in the middle, densely shagreened with small granules laterally; tubercles of the median eyes smooth; median eyes separated from each other by more than their diameter; lateral eyes arranged in slight curve; posterior margin of prosoma almost straight; anterior margin with a row of long setae; two setae situated behind median eyes, and few setae also on the surface.

Mesosoma: tergites I–VI shiny, smooth, slightly shagreened on lateral sides; the VIIth tergite with sparse granulation; sternites shiny, smooth, with a row of setae on the posterior margin, except the seventh sternite with four smooth carinae, with few setae laterally. **Pectines:** 12–14 teeth in females, 17–18 in males. **Metasoma:** all metasomal segments longer than wide; the first segment smooth with a few granules, dorsal carinae, laterodorsal and lateroventral

Table 1. Morphometric values (in mm) of *Nebo yemenensis* from Saudi Arabia (this study) and *N. hierichonticus* from Egypt (♀).
Таблица 1. Промеры (в мм) *Nebo yemenensis* из Саудовской Аравии (оригинальные данные) и *N. hierichonticus* из Египта (♀).

Characters	***Nebo yemenensis* (Jizan, Saudi Arabia) adult**			***Nebo hierichonticus* (Egypt)**
	female	**female**	**malr**	**female**
Total body length	97.5	90.47	85.13	86.3
Carapace length	14.6	12.96	12.15	10.5
Carapace posterior width	14.8	12.50	11.98	10.4
Mesosoma length	24.2	24.11	23.03	23.6
Telson length	11.3	9.48	9.75	10.2
Metasoma segment I, L/W/H	9.0/ 6.0/ 4.6	8.17/5.85/4.56	8.12/5.65/4.18	7.1/ 3.7/ 3.0
Metasoma segment II, L/W/H	9.1/ 5.5/ 4.5	8.28/5.48/4.33	7.80/4.77/3.85	7.0/ 3.5/ 3.3
Metasoma segment III, L/W/H	10.9/ 5.3/ 4.4	9.21/5.09/4.21	9.10/4.63/3.81	7.9/ 3.2/ 3.3
Metasoma segment IV, L/W/H	11.9/ 4.6/ 4.3	10.24/4.55/4.12	9.75/4.14/3.62	8.9/ 3.0/ 2.9
Metasoma segment V, L/W/H	14.3/ 4.0/ 4.0	12.90/3.83/3.98	12.23/3.45/3.72	11.5/ 2.5/ 2.9
Vesicle length	8.7/ 5.3	8.26/4.58	7.82/4.47	6.9/ 4.0
Femur L/W	12.4/ 5.0	10.41/4.71	9.55/4.61	9.7/ 3.7
Patella L/W	13.0/ 5.2	10.85/4.65	9.97/4.47	9.1/ 4.8
Chela L/ W	26.4/ 10.7	23.17/8.34	22.34/6.99	19.7/ 7.4
Movable finger length	15.6	13.90	13.96	11.7
Pectinal teeth count	14/12	14/14	18/17	13/12

Abbreviations: length (L), width (W) and height (H).

Table 2. Comparison between *Nebo yemenensis* and *N. hierichonticus* from Egypt based upon selected morphometric ratios of adult females.
Таблица 2. Сравшение самок *Nebo yemenensis* и *N. hierichonticus* (из Египта) по некоторым морфометрическим соотношениям.

Ratio (Francke 1980)	***Nebo yemenensis***	***Nebo hierichonticus***
Carapace length/metasoma segment II length	1.58 (3) (1.50–1.60)	1.5 (3) (<1.60)
Pedipalp femur length/width	2.34 (3) (2.30–2.60)	2.62 (3) (>2.65)
Metasom a segment V length/ pedipalp chela movable finger length	0.92 (3) (0.90–1.00)	0.98 (3) (>0.90)
Metasoma segment V length/ carapace length	0.98 (3) (0.90–1.00)	1.09 (3) (>1 .10)
Metasoma segment V length/ metasoma segment II width	2.47 (3) (2.30–2.55)	3.28 (3) (>2.55)
Pedipalp chela length/width	2.62 (3) (2.45–2.55)	2.66 (3) (>2.30)
Pedipalp femur length/ pedipalp chela width	1.20 (3) (1.20)	1.31 (3) (>1.15)

carinae of the first segment smooth with fused granules; dorsal carinae of segments II–IV with slightly separated granules usually in the posterior part of a carina; laterodorsal carinae of segment V consisting of several rows of small pointed granules, and the lateroventral carina consisting of distinct denticles; segment I with smooth, complete intermediary carinae; intermediary carinae of segments II–III incomplete; intermediary carinae of segment IV slightly indicated by small granules; intermediary carinae of segment V distinct, with fused or separate granules; all segments smooth ventrally; ventral carinae of segments I–III smooth, with fused granules; ventral carinae of segment IV smooth, with separate granules; axial carinae of segment V with markedly large pointed granules. **Telson**: 5–6 time longer than aculeus, aculeus curved, with large granulated subaculear tubercle, bearing numerous setae. **Pedipalps:** femur with distinctly granulated carinae, densely granulated dorsally, ventrally, and internally, with accessory setae. Patella with pedicular tubercles and carinae, most carinae with smooth or fused granules, but the median carinae with large, rounded separate granules, almost smooth ventrally. Chela manus large, slightly longer than wide; ventral, and outer dorsal



Fig. 4. Natural habitat of *Nebo yemenensis* from Al-Dayer, Jizan Province, Saudi Arabia.
Рис. 4. Биотоп *Nebo yemenensis* из Al-Dayer, Джизан, Саудовская Аравия.

carinae smooth; internal side of hand granulated, reticulated and slightly shagreened. **Trichobothriotaxy**: type C, orthobothriotaxic as described by Vachon [1965: 313, 1974: 917]. **Legs:** basitarsus of legs I to IV with 4–6 spines near the spur: tarsus of legs I to IV with 6–10 spines arranged in two rows.

ECOLOGY. The specimens of *N. yemenensis* have diagnostically relevant morphometric ratios revealed to the holotype and paratype except pedipalp chela length/width has slightly higher than determined by Franke [1980] (Tables 1, 2). As a result of our survey, some remarks on the ecology of *N. yemenensis* can be made in terms of adaptation to climatic conditions and àbiotic preferences. Scorpions were collected in the highlands of the Sarawat Mountains from Sawda (Asir Province), and in in the highlands of Jizan (Jizan Province) (Fig. 4). The species was recorded in the rocky areas and under stones covered by herbaceous plants from 1500 to 2800 m altitude, with annual rainfall between 40–85 mm [Hasanean, Almazroui, 2015] This altitude seems like Franke [1980] altitudes that he records 9000 ft (2743 m) near Sana'a, Yemen. Other scorpion species, found in this region, seem to share this habitat and distribution pattern, including *Butheolus anthracinus* (Pocock, 1895), *Hottentotta scaber* (Ehrenberg, 1828), and *Leiurus haenggii* Lowe *et al*., 2014.

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